National Aeronautics and Space Administration

Goddard View

Volume 9 Issue 3
April 2013

Senator Mikulski Visits Goddard

Pg 3

LLCD Integrated, Ready to Launch

Pg 4

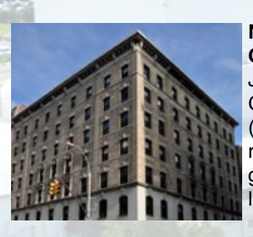
NGIMS Open House

Pg 9

www.nasa.gov

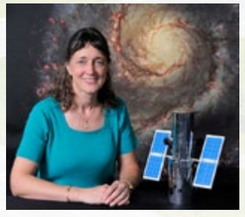
GoddardView

THE WEEKLY



NASA's Hansen to Hand Over Reins of GISS Director
James E. Hansen, director of NASA's Goddard Institute for Space Studies (GISS) in New York, has announced he is retiring as the GISS director and leaving government service. Click the image to learn more about GISS and Hansen.

Earth from Orbit in 2012 Video
This video takes a look back at the best views of our planet from space in 2012, including true-color satellite images, Earth science data visualizations, time lapses from the International Space Station and computer models. Click the image to see the video.



The Public is Invited to Free Lecture: 'Finding Other Worlds Beyond Our Solar System'
Experience "Stars and Planets Everywhere! Finding Other Worlds Beyond Our Solar System," on April 10 at the Goddard Visitor Center. Click on the image to learn more.

All Hands on NASA FY 2014 Budget Request
NASA Administrator Bolden willdiscuss fiscal year 2013 budget request during an Agency-wide all hands meeting on April 10, from 11-12. After the presentation, Center Director Chris Scolese will take questions. Check Dateline for more info.

On the cover: Center Director Chris Scolese greets Sen. Barbara Mikulski on her arrival at Goddard.

Photo credit: NASA/Goddard/Bill Hrybyk

GoddardView

Goddard View is an official publication of NASA's Goddard Space Flight Center. Goddard View showcases people and achievements in the Goddard community that support Goddard's mission to explore, discover, and understand our dynamic universe. Goddard View is published weekly by the Office of Communications.

News items for publication in *Goddard View* must be received by noon Wednesday of each week. You may submit contributions to the editor via e-mail at john.m.putman@nasa.gov. Ideas for new stories are welcome but will be published as space allows. All submissions are subject to editing.

CONTENTS

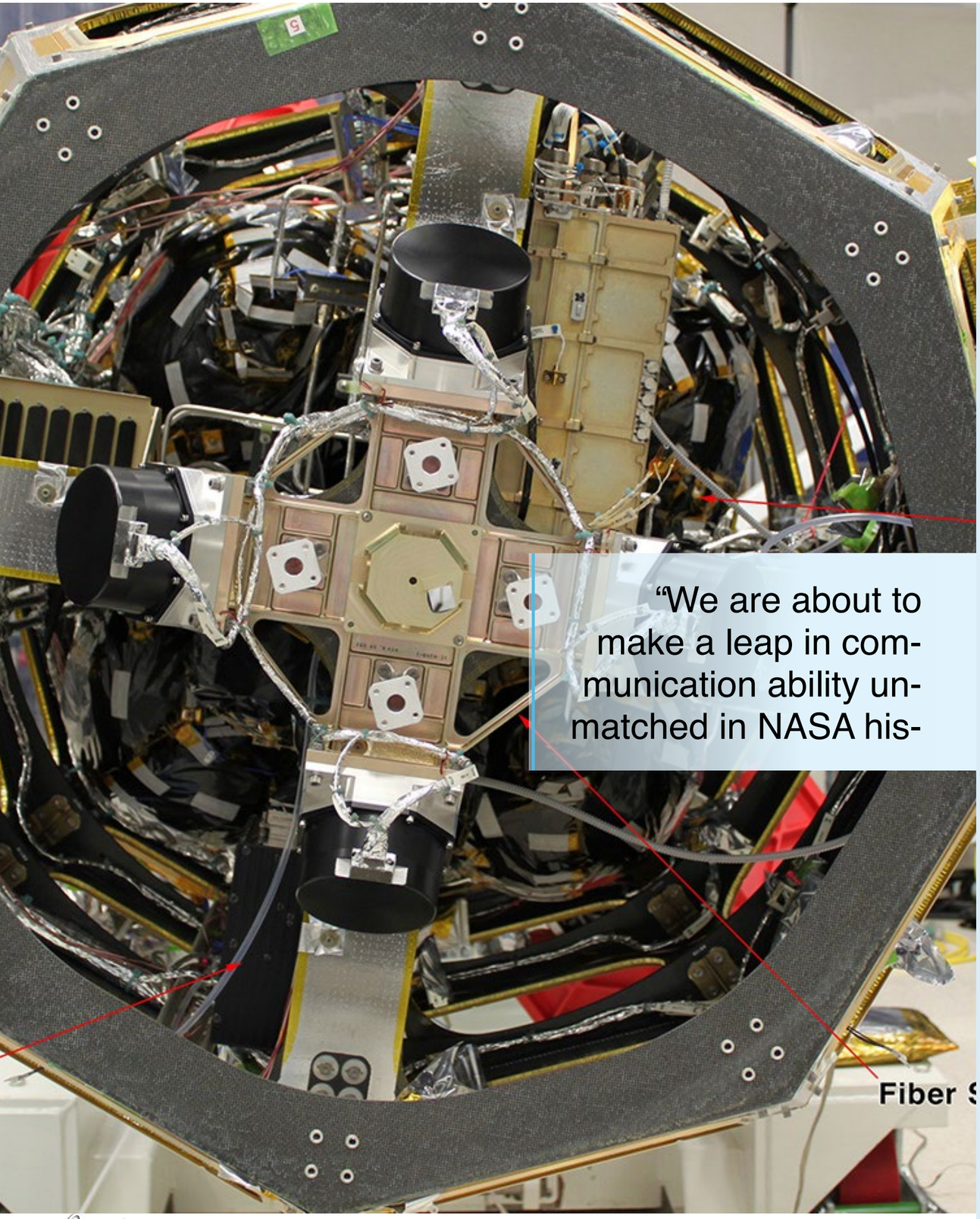
SENATOR MIKULSKI VISITS GODDARD

On March 18, U.S. Senator Barbara A. Mikulski (D-Md.), Chairwoman of the full Senate Appropriations Committee and the Commerce, Justice, Science Appropriations Subcommittee met with Center Director Chris Scolese as well as James Webb Space Telescope, Wallops Flight Facility (WFF) and other key Goddard leadership. During the meeting Chairwoman Mikulski discussed the urgent need to cancel sequester, as well as her leadership in working to avoid a government shutdown by passing a continuing resolution (CR). With the Chairwoman's leadership, funding for NASA was passed in both the House and the Senate and was signed by the President on March 26.

The senator also had a very special meeting with two astronauts. NASA astronaut Sunita Williams and JAXA astronaut Akihiko Hoshide, both of International Space Station Expeditions 32 and 33 were at Goddard to share their spaceflight experiences with the center community. Sunita Williams has a Maryland connection as a graduate of the Naval Academy.

"NASA Goddard is home to leaders in Maryland's space and innovation economies, making discoveries that not only win Nobel Prizes, but create new products and jobs," Chairwoman Mikulski said. "I want to cancel the sequester and come up with a balanced solution with smart reforms to the tax code and mandatory spending while making strategic targeted cuts. It's time for Congress to act with the fierce urgency of now and put an end to the politics of brinkmanship, shutdown, showdown, slamdown, and avert a government shutdown." ■

Above: Sen. Barbara Mikulski visits Goddard and meets NASA Astronaut Sunita Williams and JAXA Astronaut Akihiko Hoshide of Expedition 33/32. Also pictured are Center Director Chris Scolese (far left) and Dr. John Mather (far right). Photo credit: NASA/Goddard/Bill Hrybyk



"We are about to make a leap in communication ability unmatched in NASA his-

NASA'S FIRST LASER COMMUNICATION SYSTEM INTEGRATED, READY FOR LAUNCH

By: Dewayne Washington

A new NASA developed laser-based space communication system will enable higher-rates of satellite communications similar in capability to high-speed fiber optic networks on Earth.

The space terminal for the Lunar Laser Communication Demonstration (LLCD), NASA's first high-data-rate laser communication system, was recently integrated onto the Lunar Atmosphere and Dust Environment Explorer (LADEE) spacecraft at NASA's Ames Research Center, Moffett Field, Calif. LLCD will demonstrate laser communications from lunar orbit to Earth at six times the rate of the best modern-day advanced radio communication systems.

"The successful testing and integration of LLCD to LADEE is a major accomplishment," says Donald Cornwell, LLCD mission manager at NASA's Goddard Space Flight Center in Greenbelt, Md. "It demonstrates that this new technology is robust and ready for space. This is the first time NASA has had such a communication system pass all its tests and be certified flight ready."

The LLCD mission will use a highly reliable infrared laser, similar to those used to bring high-speed data over fiber optic cables into our workplaces and homes. Data, sent in the form of hundreds of millions of short pulses of light every second, will be sent by the LADEE spacecraft to any one of three ground telescopes in New Mexico, California and Spain.

The real challenge of LLCD will be to point its very narrow laser beam accurately to ground stations across a distance of approximately 238,900 miles while moving. Failure to do so would cause a dropped signal or loss of communication.

"This pointing challenge is the equivalent of a golfer hitting a 'hole-in-one' from a distance of almost five miles," says Cornwell. "Developers at the Massachusetts Institute of Technology's (MIT) Lincoln Laboratory have designed a sophisticated system to cancel out the slightest spacecraft vibrations. This is in addition to dealing with other challenges of pointing and tracking the system from such a distance. We are excited about these advancements."

The LLCD mission will also serve as a pathfinder for the 2017 launch of NASA's Laser Communication Relay Demonstration (LCRD). That mission will demonstrate the long-term viability of laser communication from a geostationary relay satellite to Earth. In a geostationary orbit the spacecraft orbits at the same speed as Earth, which allows it to maintain the same position in the sky.

Engineers believe that future space missions will be able to use laser communication technology with its low mass and power requirements, to provide increased data quantity for real-time communication and 3-D high-definition video. For example, using S-band communications aboard the LADEE spacecraft would take 639 hours to download an average-length HD movie. Using LLCD technology that time would be reduced to less than eight minutes.

Prior to shipment from MIT, the LLCD spaceflight hardware was subjected to a rigorous set of flight test simulations such as the strong vibrations expected from a Minotaur V rocket, the launch vehicle for the LADEE mission. The LLCD hardware also had to withstand simulated extreme temperatures and other conditions it will experience within the harsh environment of space. Throughout this stringent battery of tests, LLCD maintained its critical alignment and stable pointing accuracy.

Flight and ground station hardware for LLCD was designed and built at Lincoln Laboratory in Lexington, Mass. NASA's Jet Propulsion Laboratory in Pasadena, Calif., and the European Space Agency are developing the ground stations in California and Spain, respectively.

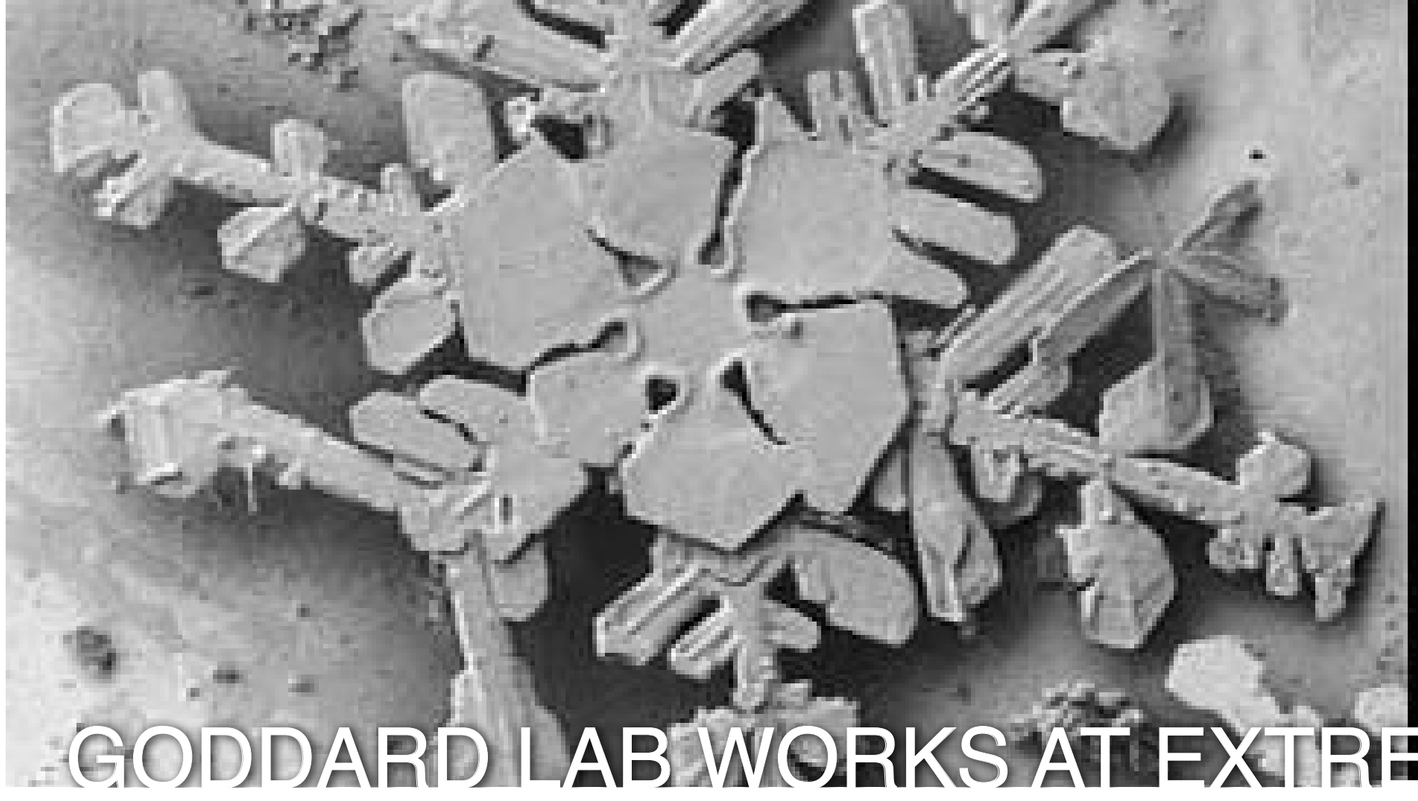
"This is an exciting time for space communications," says Cornwell. "We are about to make a leap in communications ability that is unmatched in NASA's history."

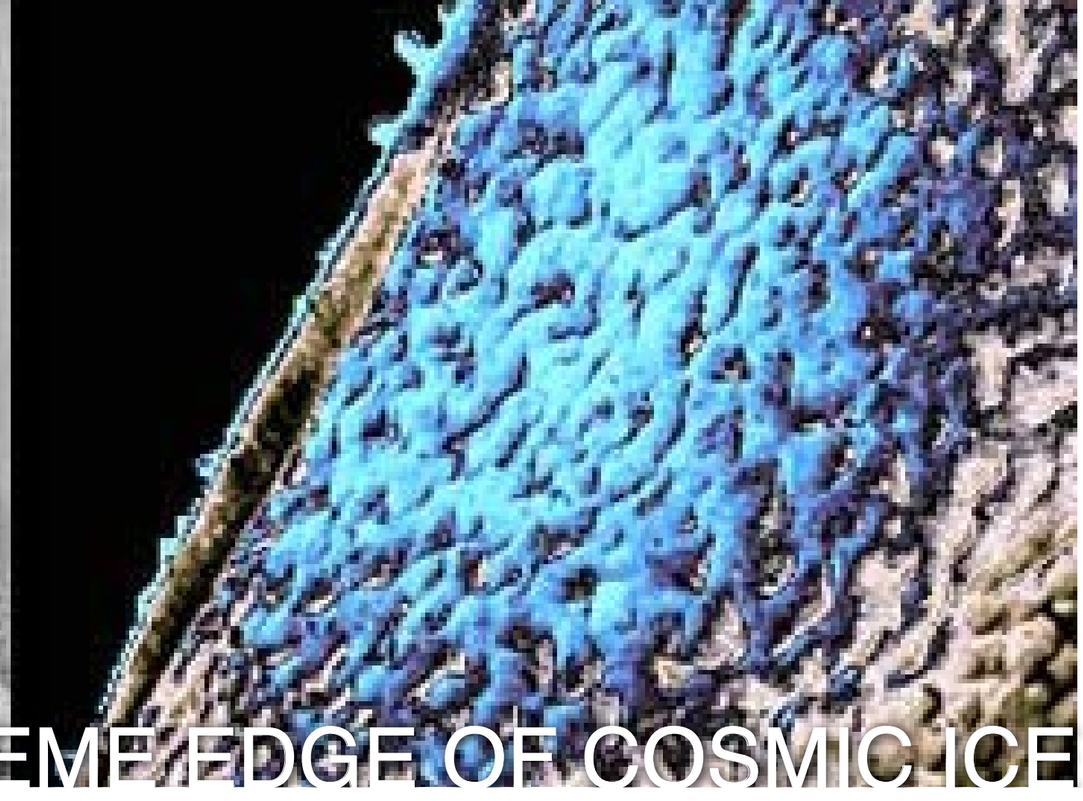
The LLCD mission management team resides at Goddard under the sponsorship of the Space Communications and Navigation (SCaN) Program at NASA Headquarters in Washington. The LADEE mission is managed by Ames under the sponsorship of NASA's Planetary Science Division within the Science Mission Directorate at NASA Headquarters.

NASA's Science Mission Directorate in Washington funds LADEE, a cooperative effort led by Ames, which is responsible for managing the mission, building the spacecraft and performing mission operations. In addition to managing the LLCD payload, Goddard is responsible for managing the science instruments and the science operations center. NASA Wallops Flight Facility has the responsibility for launch vehicle integration, launch services and launch range operations. NASA's Marshall Space Flight Center, Huntsville, Ala., manages LADEE within the Lunar Quest Program Office.

The LADEE mission, on which LLCD is a hosted payload, is scheduled to launch in August 2013. ■

Opposite: The space terminal for the Lunar Laser Communication Demonstration (LLCD) integrated onto the Lunar Atmosphere and Dust Environment Explorer (LADEE) spacecraft. Photo credit: NASA





GODDARD LAB WORKS AT EXTREME EDGE OF COSMIC ICE

By: Elizabeth Zubritsky

Behind locked doors, in a lab built like a bomb shelter, Perry Gerakines makes something ordinary yet truly alien: ice.

This ice needs such intense cold and low pressure to form that the right conditions rarely occur naturally on Earth. When Gerakines makes the ice, he must keep the layer so microscopically thin it is dwarfed by a grain of pollen.

These ultrathin layers are perfect for recreating some of the key chemistry that takes place in space. In these tiny test tubes, Gerakines and his colleagues in the Cosmic Ice Lab at Goddard can reproduce reactions in ice from almost any time and place in the history of the solar system, including some that might help explain the origin of life.

“This is not the chemistry people remember from high school,” says Reggie Hudson, who heads the Cosmic Ice Lab. “This is chemistry in the extreme: bitter cold, harsh radiation and nearly non-existent pressure. And it’s usually taking place in gases or solids, because generally speaking, there aren’t liquids in interstellar space.”

The Cosmic Ice Lab is one of a few laboratories worldwide where researchers have been studying the ultracool chemistry of cosmic ice. With its powerful particle accelerator, the Goddard lab has the special ability to mimic almost any kind of solar or cosmic radiation to drive these reactions. And that lets them dig deep to study the chemistry of ice below the surface of planets and moons as well as ice in space.

In a vacuum chamber about the size of a lunchbox, Gerakines recreates a little patch of deep space, in all its extremes. He pumps out air until the pressure inside drops to a level a billion times lower than normal for Earth, then chills the chamber to minus 433 degrees Fahrenheit. To get ice, all that remains is to open a valve and let in water vapor.

The instant the vapor molecules enter the chamber they are literally frozen in their tracks. Still pointing every which way, the molecules are transformed immediately from their gaseous state into the disorderly solid called amorphous ice.

Amorphous ice is exactly the opposite of the typical ice on Earth, which forms perfect crystals like those that make up snowflakes or frost needles. These crystals are so orderly and predictable that this ice is considered a mineral, complete with a rating of 2.5 on the Mohs scale of hardness.

Though almost unheard of on Earth, amorphous ice is so widespread in interstellar space that it could be the most common form of water in the universe. Left over from the age when the solar system was born, it is scattered across vast distances, often as particles no bigger than grains of dust. It’s also been spotted in comets and icy moons.

The secret to making amorphous ice in the lab, Gerakines finds, is to limit the layer to a depth of about half a micrometer—thinner than a strand of spider’s silk.

“Water is such a good insulator that if the ice gets too thick, only the bottom of the sample, closer to the cooling source, will stay sufficiently cold,” says Gerakines. “The ice on top will get warm enough to crystallize.”

The superthin ice can be spiked with all kinds of interesting chemicals found in space. One set of chemicals that Gerakines works with is amino acids, which are key players in the chemistry of life on Earth. Researchers have spent decades identifying a whole smorgasbord of amino acids in meteorites as well as one found in a sample taken from a comet.

“And because water is the dominant form of frozen material in the interstellar medium and outer solar system,” says Gerakines, “any amino acids out there are probably in contact with water at some point.”

Gerakines makes three kinds of ice, each spiked with an amorphous form of an amino acid (glycine, alanine or phenylalanine) that is found in proteins. The real action begins when Gerakines hits the ice with radiation.

Gerakines looks at cosmic radiation, which can reach ice hidden below the surface of a planet or moon. To mimic this radiation, he uses a proton beam from the high-voltage particle accelerator that resides in an underground room lined with immense concrete walls for safety.

With the proton beam, a million years’ worth of damage can be reproduced in half an hour. By adjusting the radiation dose, Gerakines can treat the ice as if it were lying exposed or buried at different depths of soil in comets or icy moons and planets.
He tests the three kinds of water-plus-amino-acid ice and compares them to ice made from amino acids only. Between blasts, he checks the samples using a “molecular fingerprinting” technique called spectroscopy to see if the amino acids are breaking down and chemical by-products are forming.

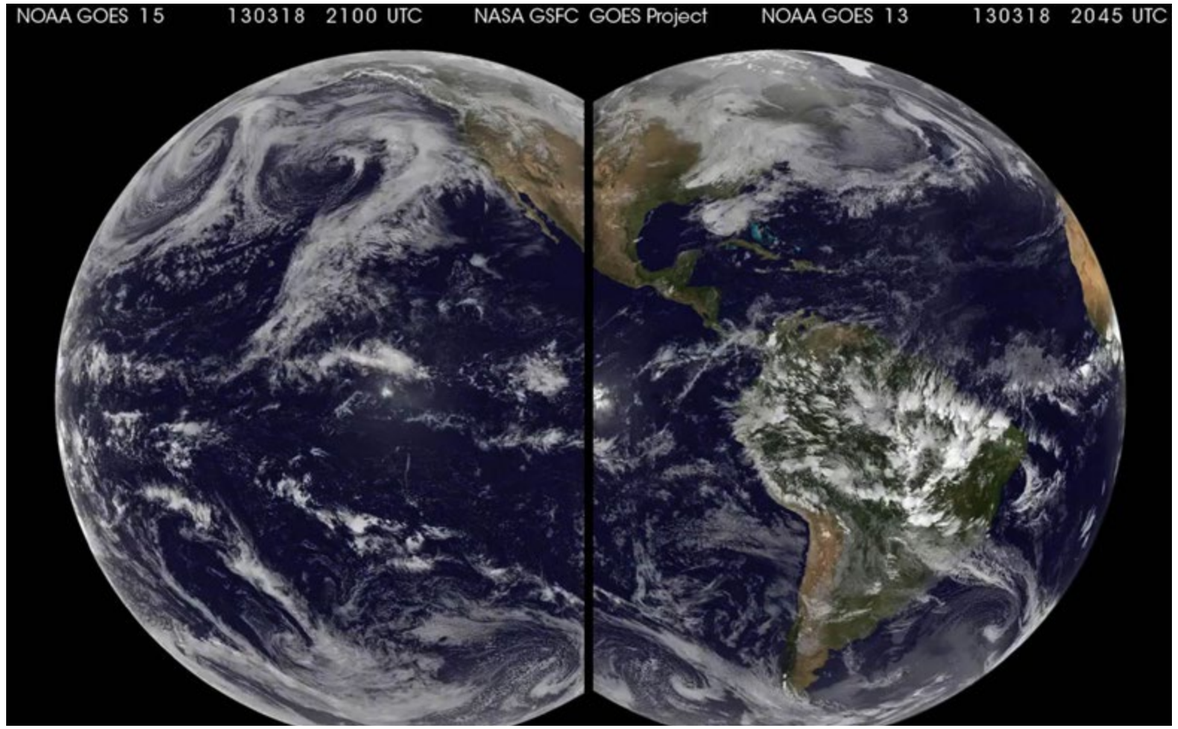
More and more of the amino acids break down as the radiation dose adds up. Gerakines notices that the amino acids last longer if the ice includes water than if they are left on their own. Overall, says Gerakines, “the water is essentially acting like a radiation shield, probably absorbing a lot of the energy, the same way a layer of rock or soil would.”

Gerakines repeats the experiments at higher temperatures and finds the acids fare better. From these preliminary measurements, he and Hudson calculate how long amino acids could remain intact in icy environments over a range of temperatures.

“We find that some amino acids could survive tens to hundreds of millions of years in ice near the surface of Pluto or Mars and buried at least a centimeter [less than half an inch] deep in places like the comets of the outer solar system,” says Gerakines. “For a place that gets heavy radiation, like Europa, they would need to be buried a few feet.”

“The good news for exploration missions,” says Hudson, “is it looks as if these amino acids are actually more stable than anybody realized at temperatures typical of places like Pluto, Europa and even Mars.” ■

Above: The familiar forms of ice, including snowflakes (left), are built from crystals, but amorphous ice (right) is unstructured. Credits: NASA/Earth Observatory (left) and NASA/ARC/P. Jenniskens and D.F. Blake (right)



NEW LIVE BI-OCULAR ANIMATIONS OF TWO OCEANS NOW AVAILABLE

By: Rob Gutro

NOAA's GOES-13 and GOES-15 weather satellites sit 60 degrees apart in a fixed orbit over the eastern and western U.S., respectively, providing forecasters with a look at the movement of weather systems in the Atlantic and Pacific Oceans. The GOES Project at the NASA's Goddard Space Flight Center in Greenbelt, Md. announced the creation of satellite animations of both GOES-13 and GOES-15 to show continuous views of both oceans, with conjoined images reminiscent of binoculars.

NOAA's Geostationary Operational Environmental Satellites collect full disk images of the eastern and western sides of the Americas every 3 hours, providing 8 views per day of the clouds over the entire western hemisphere. Overlaid on color maps, the time-series of GOES cloud images provide a review of the large-scale weather.

Recently, Dennis Chesters of the NASA GOES Project created an algorithm that combined the full disk images from both GOES-13 and GOES-15 (or GOES-EAST and GOES-WEST) into a wide animation that shows two rounded images of the Earth and the Atlantic and Pacific oceans as if you were looking with wide-set eyes.

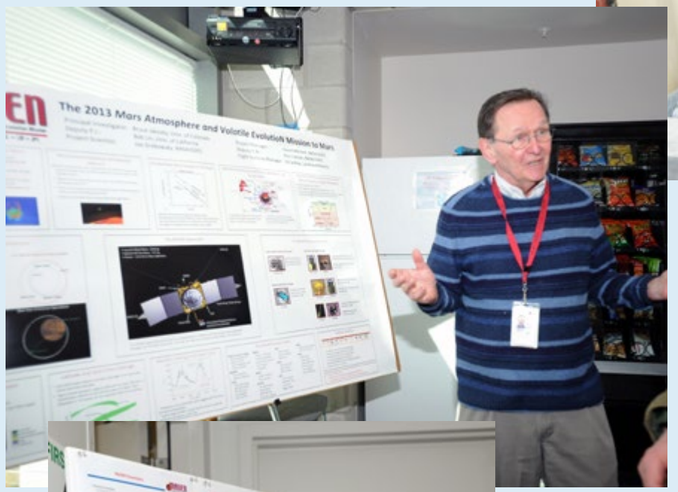
"I was inspired to create this 10-day long, up-to-date, animation of the western hemisphere by the long-range skill in this winter's severe weather forecasts," Chesters said. "Indeed, the forecasts are made possible by the geosynchronous satellites' ability to follow storms carried around the world by the westerlies." The imagery is amazing because it provides a wide view of systems moving around one half of the world in a single animation that can track a weather system moving through the Pacific across the Continental U.S and into the Atlantic, on its way to Europe.

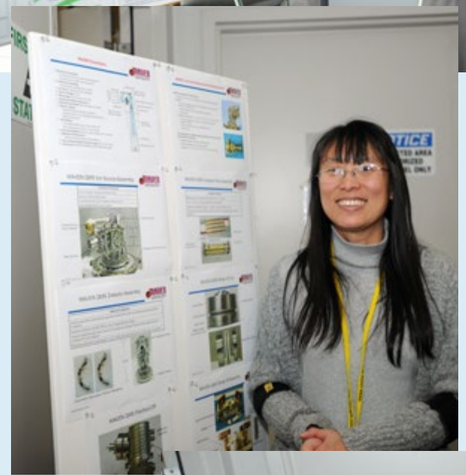
To see the dual ocean GOES Satellite animations, visit the NASA GOES Project webpage at http://goes.gsfc.nasa.gov/, and click on " Two-disk movie." The movies are downloadable from the site and updated every hour.

NOAA manages the GOES program, establishes requirements, provides all funding and distributes environmental satellite data for the United States. NASA Goddard procures and manages the design, development and launch of the satellites for NOAA on a cost reimbursable basis. ■

Above: This new combination video of NOAA's GOES-13 and GOES-15 satellite data shows two rounded images of the Earth as if you were simultaneously looking at the Atlantic and Pacific oceans with very wide-set eyes. The animation runs from March 19, 2013 at 1200 UTC to March 29 at 1200 UTC. Photo credit: NASA/NOAA GOES

NGIMS OPEN HOUSE





On Friday, March 15, Goddard employees had the chance to view the Goddard-built Neutral Gas and Ion Mass Spectrometer (NGIMS) instrument. NGIMS will soon be integrated with the Mars Atmosphere and Volatile EvolutioN (MAVEN) spacecraft in preparation for its voyage to Mars. MAVEN is the first spacecraft devoted fully to exploring and better understanding the Martian upper atmosphere.

At the Open House, employees viewed the powerful instrument and heard from project staff about the mission.

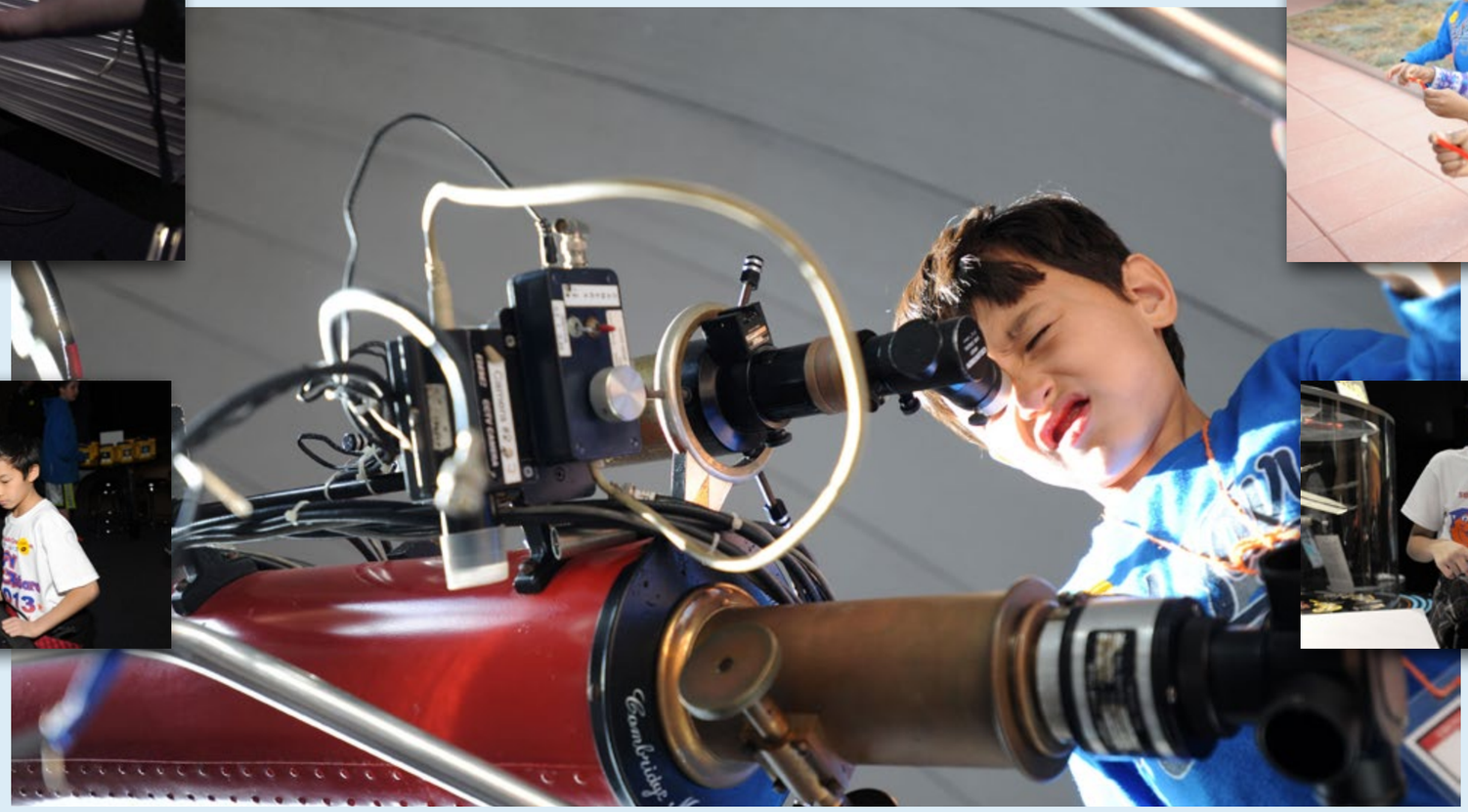
NGIMS is designed to measure neutral gas, ions, and isotopes in the upper atmosphere of Mars. NGIMS incorporates two ion sources, a quadrupole radio frequency mass analyzer, and a pulse counting detector system. NGIMS works in concert with other MAVEN particle and field instruments, and an imaging ultraviolet spectrograph as the spacecraft dips in and out of the upper atmosphere to study the rate of loss of atmospheric gases as a function of solar input. This data set will provide a basis for models of present and past atmospheric loss and a better understanding of the history of Martian climate, and if conditions on early Mars may have been more conducive for supporting microbial life.

MAVEN is scheduled to launch in November 2013. ■

Photo credit: Debora McCallum

SUN EARTH DAY 2013

By: Karen C. Fox



Every year, near the spring equinox, Goddard hosts an extravaganza on the science of the sun and its interactions with Earth, a field known as heliophysics. On March 22, 2013, experts from Goddard visited both NASA's Wallops Flight Facility on Virginia's eastern shore and the Maryland Science Center in Baltimore. The theme for the event was Solar Max – Storm Warning!

The day is part of a yearlong program of presentations and events – many hosted by museums and educators around the world – to celebrate the science of our connected sun-Earth system. Collectively, the events are known as Sun-Earth Days.

The Sun Earth Days team joined forces with the producers of NASA EDGE. NASA EDGE is an unscripted, non-traditional video podcast (vodcast) that combines funny, offbeat and informative sketches, features and interviews. NASA EDGE led a live webcast from Wallops, which is NASA's principal facility for management and implementation of suborbital research programs. Wallops is responsible for launching many of NASA's Heliophysics sounding rockets.

The event focused on how active and dynamic the sun is as it nears the peak of solar activity, known as solar maximum, expected to occur in 2013. Participants included: Goddard solar scientist Alex Young, who discussed NASA's heliophysics space missions, which help scientists better understand what causes the giant explosions on the sun such as solar flares and coronal mass ejections; Dan Smith, a scientist at Johns Hopkins' Advanced Physics Laboratory, who discussed the Van Allen Probes mission studying Earth's radiation belts; and Goddard space scientist Doug Rowland, who discussed a sounding rocket mission called VISIONS that studied streams of oxygen produced during aurora called the auroral wind.

During the webcast, the team announced the first two -- of an eventual five total -- winners of the Sun-Earth Days' Anime Contest, a contest to create superhero sidekicks for SolarMAX, the official super hero mascot for NASA's Sun-Earth Days. The winners were Maria Malcia, an 8th grader at the National High School of Computer Science in Tudor Vianu, Bucharest for a superhero called Aurora and WooKyung Lee at Suyvesant High School in New York City for a superhero named Queen Solaris.

At the Maryland Science Center, over 2,000 children participated in hands-on activities with Goddard educators. The children learned about the solar cycle, solar maximum, space weather and how space weather can affect orbiting spacecraft and even technology here on Earth. Up on the rooftop, visitors could observe the sun through a solar telescope as well as experiment with special beads that change color in response to the sun's ultraviolet light. ■

Photo credit: NASA/Goddard/Deborah McCallum

OUTSIDE GODDARD

By: Elizabeth M. Jarrell

GROWING UP WITH SOCCER

Dr. Dave Whiteman, a physical scientist, grew up playing baseball. He only played soccer by accident, replacing the team's goalie for one season, but is now a dedicated soccer fan. "Soccer is a fantastic sport especially for kids," says Whiteman. "It's physically active and develops stamina, it's cheap, and it's the world sport." His two young girls are growing up with soccer.

Whiteman was a driving force behind the creation of the Greenbelt Soccer Alliance (GSA), an organization that focuses on providing pure recreational, small-sided soccer for children. He is currently the president and a coach. GSA is a City of Greenbelt Recognition Group, which entitles them to obtain permits to use the city's soccer fields and meeting rooms without charge.

The idea behind recreational soccer is simple: Since parents cannot let their kids go outside and run around without supervision these days, parents rely on community organizations to provide their kids physical outlets in the form of supervised, safe activities. "Kids have to blow off steam," says Whiteman. "When parents put their kids to bed, they want them to conk out so the parents can get some piece of mind." Soccer is his way of teaching children to enjoy and have fun doing physical activities.

"Pure recreational soccer does not have any tryouts, official scores, or standings. We have rules designed to even out the competition between teams. Everyone is guaranteed to play 50 percent of the game regardless of ability," explains Whiteman. In contrast, select recreational soccer has tryouts but uses rules to even out the competition. "With travel team soccer," says Whiteman, "using professional coaches means you are in it to win it."

In small-sided soccer, the youngest kids play on the smallest field with the smallest number of kids on a team. The point is to allow the kids to run between the goals quickly enough to maintain their attention and allow them to successfully make goals. "If the field is too big," says Whiteman, "the youngest kids start to pick flowers instead of playing soccer." Even three-year-old children can play. "You keep the youngest kids engaged by making it all about fun. If they happen to kick a ball on the field, so much the better." Small-sided soccer, which developed in the poor areas of places like Argentina with limited space and sometimes fewer children, is the model endorsed by the U.S. Youth Soccer Association and to which Maryland's soccer Association belongs.

Whiteman believes that people evolved through natural selection to be competitive by nature. Although not against competition, he feels that competition should be developmentally appropriate. Even though there are no official scores, the kids themselves keep score and create a competitive environment. He is concerned that young kids who pressure themselves to succeed could be crushed by losing. "It is not developmentally appropriate or healthy for the league and parents to add additional pressure to win. Also, we want to avoid bad behavior from overly-competitive parents," says Whiteman. As the kids grow older and their physical strength and cognitive abilities increase, they then play on larger fields. "Competition is a matter of age and environment," he says. "Older kids can handle more competition."

Some could question whether or not pure recreational, small-sided soccer prepares children for the real world. "There are things that an adult might do that are not appropriate for a kid to do. We are establishing an environment more appropriate for kids to develop in that is reflective of our ideals. This is in recognition that we as humans are flawed by our competitive nature," explains Whiteman. He adds that parents who do not subscribe to this developmental theory can always find competitive soccer leagues for their children; he is merely providing a non-competitive option.

With great emotion, Whiteman recalls hosting a dinner at his home for a NASA workshop with international attendees. The dinner was held around the time of the 2010 World Cup for soccer. He watched with amazement as his then eight-year-old daughter spoke freely and easily with people of various nationalities about soccer and the World Cup. "I thought to myself – soccer is training for living in the global community. Learning about the world's most popular sport connects my daughter with the rest of the world. Soccer is something everyone around the world can talk about with great passion," he says. And he does. ■

Below: Whiteman and his daughters. Photo provided by Dave Whiteman